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THE LESSONS OF MANILA BAY.

The brilliant operations of the American fleet in Manila Bay have served to emphasize several well established principles of naval warfare, the truth of which has been recognized through many centuries of struggle for the mastery of the seas. We believe it was Napoleon who said that Providence was on the side of big battalions. That may be true on land, but the history of sea fights without number has taught us that Providence is on the side of forethought, good judgment, discipline, dash, well-timed audacity and above all straight shooting. All of these qualities were conspicuously present in the compact little squadron of half a dozen ships which in the gray dawn of that eventful morning circled around the bay before the astonished gaze of the enemy and at a predetermined hour and on a predetermined plan began to blot the Asiatic fleet of Spain out of existence.

The two most important facts brought out by the Manila fight are the ability of modern ships, even of the unarmored types, to engage land fortifications, and the incomparable value of accurate gunnery as a means of defense against the shell-fire of the enemy. The astonishingly small casualties to our ships and their crews during several hours of fighting is not all to be credited to poor marksmanship on the part of the Spanish gunners. It was largely the result of the rapidity and deadly accuracy of the storm of shells thrown by our vessels, which rendered the gun positions untenable and probably disabled the crews faster than they could be placed at the guns. A crack marksman behind a modern high-powered rifle is worth whole inches of armor protection to the ship on which he serves, and it begins to look as though the theorists might prove to be correct who contend that modern fights will be decided by killing off the gun crews rather than by penetrating belts and demolishing unarmored ends and upper works.

Not less remarkable is the fact that half a dozen unarmored cruisers should have run past shore batteries of considerable strength and blown out of existence a fleet that held a strong position under the guns of a powerful battery. The supreme confidence with which this supposedly impossible feat was undertaken is only equaled by the splendid audacity and cool deliberation with which it was carried out. If the Spanish fleet was taken unawares, it was because its admiral judged—as by all the canons of naval warfare he was justified in doing—that the American fleet of cruisers would never dare to undertake an attack for which only heavily armored battleships are supposed to be available. The success with which the fortifications in Manila Bay were attacked is certain to enhance the value of the swift cruiser as against the more cumbersome battleship. The danger will be that critics will lose sight of the fact that the forts and probably the guns were not of the latest description, and will push too far the lessons that have been taught by the reduction of Cavité arsenal.

The battle has shown again the absolute necessity of removing from a warship every piece of woodwork that can possibly be spared. Our shells loaded with common brown powder served to set fire to the Spanish ships early in the fight, and had the shells been loaded with high explosives, the conflagration would have started sooner and burnt even more fiercely. Fires were started in two of our ships by exploding shells, and, though they were speedily extinguished, they emphasize the necessity for rigidly excluding all unnecessary combustible material from a warship.

The fight again demonstrated the futility of torpedo boat attack when carried out by daylight and in the open. Three separate attempts were made by these little craft to run out from the harbor and dash within firing range of the American ships, but in each case they were speedily crippled by the 6-pounder and 1-pounder rapid-fire batteries of our cruisers. The only possible danger from torpedo boats by day would be when the attack was made by a larger fleet of boats than a ship's rapid-fire guns could cover. In such a case the survivors would probably sink one or two ships of a fleet before they were themselves destroyed. Attacks by isolated boats, such as were made by the Spanish, were necessarily as futile as they were splendidly heroic.

And this suggests the reflection that mere courage and heroism can never atone for the lack of skill and efficiency. Had the Spanish crews been as skilled as they were courageous, our ships and men would never have come so scathless out of the fight. It is to the combination of both qualities in our navy that we must look for an explanation of the amazing disparity in the losses sustained on this memorable day.

We close with mention of a pleasing episode, one that is highly characteristic of the man and in accordance with the best traditions of the navy. We refer to the message which, according to an Associated Press dispatch, was sent by Commodore Dewey to the admiral of the beaten fleet: "I have pleasure in clasping your hand and offering my congratulations on the gallant manner in which you fought." True courage is ever magnanimous; and every acknowledgment of the undoubted bravery of the vanquished is an indirect tribute to the courage and skill of the victor.

FOREIGN EXPERT OPINION ON THE "MAINE" DISASTER.

It is gratifying, though not surprising, to note that the English technical press has given a practically unanimous indorsement of the finding of the Naval Court of Inquiry on the "Maine" disaster. At a time when sentiment or prejudice is dominating men's minds and rendering them incapable of cool judgment, it is to the professional expert that we must look for opinions that count for much. To him the political aspects of such a disaster as happened to the "Maine" are altogether subordinate to its scientific and technical side, and it is safe to say that the findings of our board, as against those of the Spanish commission, would not be indorsed except after an exhaustive and impartial review of the evidence.

The Engineer, of London, says: "The evidence appears to have been taken with great care and with the utmost impartiality. Whether the officers constituting the court had or had not any preconceived notions, we cannot say; if they had, they carefully concealed the fact. Indeed, throughout the whole of the evidence we fail to find expressions of opinion on the part of the witnesses, and the court carefully abstained from putting leading questions. . . . The principal value of this most elaborate and temperate inquiry lies in the lessons that can be drawn from it. It is not possible to read what the divers have to say, or to examine the sketches which they have made, without arriving at the same conclusion as the board."

The other leading technical journal, Engineering, says: "The court was of opinion that this forcing up of the bottom of the ship could only be caused by the explosion of a mine situated beneath the vessel; and at first sight it may appear difficult not to accept this view." It suggests, however, another possible way in which the bottom plating could have been bent into an inverted V, by referring to the fact that after the decks had been blown out the bow sank, while the after half of the ship was still water-borne. This, Engineering suggests, would bend the bottom plating somewhat into the shape in which it was found; but it frankly admits that "it may be objected that this is a somewhat bold flight to account for an upheaval of the keel 34 feet in such a way, and we only advance the hypothesis as possible rather than probable." It concludes by stating that "whatever may have been the primary cause of the terrible catastrophe of February 15, there is one fact that stands out with remarkable prominence. The conduct of the whole ship's company was worthy of the best traditions of the American navy; which is as high praise as could well be given. The suddenness of the catastrophe, farmore trying to discipline than the time of battle, the rapidity with which the vessel sank, the continuance of smaller explosions after the great outburst, the darkness of the night, and the fact that many of the crew were asleep, all tended to put the *morale* of the ship's company to as severe a test as could well be imagined; but throughout not a man failed in his duty."

Industries and Iron, London, has devoted two editorials to the subject, the second of which is called forth by the publication in its columns of a letter from a distinguished English engineer indorsing the findings of the "Maine" Court of Inquiry. Speaking of this letter, which we republish on another page, the journal in question says: "Our correspondent in opening his letter remarks that he is 'an old and experienced engineer,' and that he is also 'an expert on explosives.' Thus modestly one of the greatest living authorities, whose name and fame are known the world over, chooses to describe his experience and abilities. We regret that the world at large is precluded from appreciating the high value and true weight of his opinions, owing to the unfortunate circumstance that etiquette and policy require the suppression of his great name."

After discussing the points brought out in the letter, our contemporary concludes as follows: "We believe, after extremely careful consideration of the evidence, that the destruction of the 'Maine' was premeditated, that it was caused from the outside, and that if the Spanish government itself must be acquitted from actual participation in the dastardly deed, then the blame of the crime must be borne by some person or persons not remotely connected with the government. That such a disaster should have occurred at all is dreadful enough, but that it should occur through treachery when the vessel was resting in every confidence under a friendly nation's protection, is more terrible. America would have had our sympathies had the destruction of the 'Maine' proved to be accidental, and now that it has, by evidence and calm judgment, been proved to be due to a willful and premeditated act, our detestation and horror of the foul deed is absolute."

These are fairly representative quotations from the English technical journals, all of which have commented at considerable length upon the disaster, and they indicate the practically unanimous approval of

our position by that section of the press which is entitled to speak with authority on a question of this special nature.

THE FOUR NEW MONITORS.

The designs for the four new monitors called for by the Naval Appropriation Bill have been determined upon by the Naval Board of Construction. Their displacement will be about 2,500 tons on a draught not to exceed 11 feet. They will be furnished with watertube boilers and twin-screw engines of 3,500 horse power, which will be expected to drive the monitors at 12 knots under natural and 13 knots under forced draught. They are to be furnished with a single turret and a fighting mast. The turret will be carried well forward clear of obstructions. It will be protected by 12 inches of Harveyized steel, and within it will be two of our latest pattern of 10-inch rifles. On a superstructure deck amidships will be placed several 4-inch rapid-fire guns and a numerous battery of 6 and 1-pounders and machine guns. The new monitors will sit low in the water, having a freeboard of only 20 inches, and as the belt armor will consist of 11 inches of Harveyized steel, the new vessels will be very difficult objects for the enemy to hit and disable. The small draught of 11 feet will enable them to navigate shallow channels and shoals in our harbors which would be impassable to the deep draught sea-going craft of the enemy.

It will be seen that the new monitors will be 1,500 tons smaller than the "Terror," "Amphitrite" and "Miantonomoh" and 3,500 tons smaller than the "Puritan." Their speed will be about 2 knots greater than the first named boats and about the same as that of the "Puritan." They will carry only half the number of heavy guns, but their handiness, light draught and powerful secondary batteries and general up-to-date efficiency will render them scarcely less powerful than the ships of the "Terror" class.

ELECTRICAL EXHIBITION.

When we realize the multiplicity of uses to which electricity lends itself, it is little wonder that an exhibition could be inaugurated which would occupy every inch of space in the largest building available for the purpose in New York City.

Among the newer objects shown are the Edison magnetic ore separator, fully described some months since in the SCIENTIFIC AMERICAN. A large working model of this invention shows how the magnetic ore is separated from sand by the action of a magnet. Wireless telegraphy, also described in our columns not long since, is shown in actual operation. There is a large exhibit of Weston's fine testing and measuring instruments, designed for all purposes, including their use in generating stations, institutions of learning, as well as in the laboratories of private individuals. The Walker underground conduit system, lately installed on the Fourth Avenue street railway in this city, is represented by a section of full sized track and a motor car arranged to permit of examination by visitors who are interested to know how this system is operated. The Crocker-Wheeler exhibit includes a 225 horse power dynamo and several other large dynamos and motors; also motor dynamos. A motor especially adapted for use in mills is found here. The exhibit is very creditable, showing improvements in design and finish.

An exhibit showing the extended use of electricity is an emergency wagon, containing tools and materials for electrical repairs of all kinds. The American Electrical and Maintenance Company are represented by this exhibit.

The Electric Storage Battery Company's exhibit is especially noticeable on account of the giant accumulators shown. They are of a type used in Chicago and in the Brooklyn Edison Illuminating Station. One of these cells can give 2,000 amperes for one hour and the other 6,000 amperes for one hour.

The Montauk Multiphase Cable Company have on exhibition their automatic thermostatic protective electric cables. This system gives to wires the power to discover dangerous heat or flame, and automatically to notify at any point or points desired that such heat or flame is in existence, and this upon its inception. The exhibit is attracting much attention on account of its possible application to government use in the present crisis.

The domestic uses of electricity are shown by utensils for cooking according to every conceivable method by heat generated by electricity. The advantages gained by this method are cleanliness, avoidance of unnecessary heat, obviating the necessity of handling coal and ashes, and the saving of room. Another domestic application of electricity is an electrical cradle rocker.

In the generating section are shown two Babcock & Wilcox steel boilers of 265 horse power each, which provide steam for the exhibition. These boilers are furnished with low grade fuel and the fire is urged by a forced draught created by a large fan blower driven by a small engine supplied with steam from the boilers. The steam pressure controls the motion of the engine, the blast being thus varied to suit the requirements. As a consequence, a uniform pressure of steam is maintained and fuel is saved. This system of controlling the pressure by action on the fire by means of a variable forced draught is known as the Beckman system of automatic control. It is exhibited by the Kensington Engine Works, Limited, of Philadelphia.

Several high-speed steam engines driving direct-connected dynamos are shown.

The Woodbury high-speed engine with an Eddy dynamo directly attached is running. It does its work quietly and without apparent effort.

The Onondaga Dynamo Company also have a high-speed engine with one of their own dynamos direct connected. The engine runs smoothly, without a click or a jar.

There is also shown a Fischer engine with a direct-connected dynamo.

The American Engine Company exhibit an American Ball engine direct-connected to a 25 K. W. generator built by the same company.

The Armington & Sims Company exhibit a 13-inch by 12-inch engine direct-connected to a Walker generator, and the New York safety steam engine is shown connected directly with a dynamo constructed according to the Wood system by the Fort Wayne Electric Company. These engines and dynamos show to what perfection the apparatus for the generation of electricity has arrived.

The Hornsby-Akroyd safety oil engines are exhibited. These engines are operated by the vapor of kerosene oil, the oil vapor being ignited without the use of hot tubes, flames or electric sparks, as usual in gas engines.

The National Meter Company have on exhibition a 70 horse power gas engine connected direct to a generator. It does its work without trouble and is a compact and desirable form of motor.

The Diesel motor is the more recent of gas engines. It operates on a new principle. It follows the lines of a vertical marine engine and is connected directly with a dynamo. The motor cylinder is placed on a stout A-frame, in the rear leg of which a small air pump is secured. The action is on the 4-stroke or Otto cycle. It differs from all previous internal combustion engines in compressing a full charge of air to a point above the igniting point of the fuel, whether liquid or gaseous, then injecting the fuel for a certain period (variable according to load) into the red hot air, where it burns with pressure and temperature under control. There are no explosions, as in other gas or oil engines, but steady combustion at much lower temperature and without essential increase in pressure, the combustion line being practically isothermal. It is claimed that fully 28 per cent of the value of the fuel is utilized. This motor was fully described in a recent issue of this journal.

CALCIUM CARBIDE AS AN AID TO FIRE.

In the SCIENTIFIC AMERICAN for May 7 we referred to a fire caused by water coming in contact with calcium carbide. We are informed by the Creig-Reynolds Foundry Company, of Dayton, Ohio, we were in error in reporting the fire at their works as a carbide fire. The fire started in the extreme end of their warehouse building, some hundred or more feet from the carbide, and when the flames reached the carbide cans the solder was rapidly melted and the carbide, being surrounded by water, generated gas immediately, which was communicated to the flames and, consequently, made a great blaze; but, out of some 8 or 10 tons of carbide on hand, they lost less than 1,500 pounds. In no way can the fire be attributed to the storage of the carbide, and it was not to blame in any way for the origin of the fire; but the very fact that the carbide assisted the conflagration shows that the regulations regarding the storing of carbide in quantities in some cities have not been made in vain.

UNITED STATES ARMY RECRUITING CIRCULAR.

WAR DEPARTMENT, ADJUTANT-GENERAL'S OFFICE,
WASHINGTON, April 27, 1898.

The following instructions will govern recruiting for the regular army in time of war:

Applicants for enlistment must be between the ages of 18 and 35 years, of good character and habits, able-bodied, free from disease, and must be able to speak the English language. Married men will be enlisted only upon the approval of a regimental commander. Minors must not be enlisted without the written consent of father, only surviving parent, or legally appointed guardian. Boys between the ages of 16 and 18, who may be needed as musicians, may be enlisted as such, with the approval of the proper commanding officer. Original enlistments will be confined to persons who are citizens of the United States, or who have made legal declaration of their intention to become citizens thereof. Applicants will be required to satisfy the recruiting officer regarding age and character, and should be prepared to furnish the necessary evidence.

For infantry and artillery the height must be not less than five feet four inches, and weight not less than one hundred and twenty pounds and not more than one hundred and ninety pounds.

For cavalry the height must be not less than five

Table of Physical Proportions for Height, Weight, and Chest Measurement.

HEIGHT.		WEIGHT.	CHEST MEASUREMENT.	
Feet.	Inches.	Pounds.	At expiration: Inches.	Mobility: Inches.
5	4	128	32	2
5	5	130	32	2
5	6	132	32½	2
5	7	134	33	2
5	8	141	33¼	2½
5	9	148	33½	2½
5	10	155	34	2½
5	11	162	34¼	2½
6	0	169	34¾	3
6	1	176	35¼	3

feet four inches and not more than five feet ten inches, and weight not to exceed one hundred and sixty-five pounds. No minimum weight is prescribed for cavalry, but the chest measures must be satisfactory.

It is not necessary that an applicant should conform exactly to the figures indicated in the table of proportions, the variation of a few pounds in weight either way, and of a fraction of an inch in chest measures, being permissible.

Applicants must defray their own expenses to the place of enlistment. Their fitness for the military service can be determined only upon examination at a military post or other recruiting station.

The term of service is three years.

All soldiers receive from the government (in addition to their pay) rations, clothing, bedding, medicines, and medical attendance.

The following are the rates of pay as fixed by law:

Grade.	Pay per month.	Pay per year.	Pay for 3 years.
COMPANY.			
Privates—Cavalry, Artillery, and Infantry	$13	$156	$468
Field Musicians—Cavalry, Artillery, and Infantry	13	156	468
Wagoners—Cavalry, Artillery, and Infantry	14	168	504
Artificers—Artillery and Infantry	15	180	540
Saddlers—Cavalry and Light Artillery	15	180	540
Farriers and Blacksmiths—Cavalry and Light Artillery	15	180	540
Corporals—Cavalry, Artillery, and Infantry	15	180	540
Sergeants—Cavalry, Artillery, and Infantry	18	216	648
Quartermaster Sergeants—Cavalry and Light Artillery	18	216	648
Veterinary Sergeants—Light Artillery	18	216	648
First Sergeants—Cavalry, Artillery, and Infantry	25	300	900
REGIMENT.			
Quartermaster Sergeant—Cavalry, Artillery, and Infantry	23	276	828
Sergeant-Major—Cavalry, Artillery, and Infantry	23	276	828
Saddler Sergeant—Cavalry	22	264	792
Chief Trumpeter of Cavalry	22	264	792
Principal Musician—Artillery and Infantry	22	264	792

To the rates of pay enumerated above 20 percentum will be added in time of war.

In addition one dollar per month for the third year of enlistment will be paid to the soldier. Soldiers re-enlisting within three months from date of discharge receive a further increase of pay for the fourth and fifth years of service, and a still further increase for each five years of continuous service.

The soldier can deposit his savings in sums not less than $5 with any army paymaster, and for sums so deposited for the period of six months or longer, the soldier, on his final discharge, will be paid interest at the rate of four per cent per annum. These deposits are nonforfeitable except for desertion.

Whenever a soldier is honorably discharged at the expiration of his enlistment, or on account of disability not caused by his own misconduct, his travel pay is ample to carry him to the place of enlistment.

By care and economy, a soldier can save from his clothing allowance a considerable sum, payable to him on his discharge.

For soldiers who have served honestly and faithfully twenty years, or who have been discharged for wounds received or disease incurred in service, a comfortable home is maintained in the city of Washington. The sum of 12½ cents per month is deducted from each soldier's pay, to be applied toward the support of the home. After thirty years' service enlisted men are entitled to be retired, and upon retirement receive three-fourths of the monthly pay allowed by law to them in the grade they held when retired, and $9.50 per month as commutation for clothing and subsistence.

By order of the Secretary of War.
H. C. CORBIN, Adjutant-General.

PROF. RAY LANKESTER, in a recent lecture in England, gave a clear and easily understood explanation of how inoculations of mild disease will cure or prevent the severer kinds. Protoplasm, he said, had the capacity for being taught to tolerate a chemical action from which it naturally shrank. A mass of protoplasm attracted in the direction of a solution of sulphate of iron would at first grow down to the edge of it and then draw back, but in a little time would plunge boldly through and across it, and this protoplasm thenceforth would have no fear of sulphate of iron. The amœboid corpuscles of the blood are attracted by what is called "chemotaxis" to the germs of disease entering the body, and swallow them up; but these bacteria in their turn produce a poison which repels the corpuscles. The latter, however, can be taught by gradually increasing doses to tolerate the poison, and in this way the body can acquire an immunity against even the full strength of the disease.